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SYSTEM AND METHOD FOR 3D IMAGING USING STRUCTURED LIGHT ILLUMINATION

CROSS REFERENCE TO RELATED PATENTS/PATENT APPLICATIONS

The present U.S. Utility Patent Application claims priority pursuant to 35 U.S.C. §120, as a continuation, to the following U.S. Utility Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes:

1. U.S. Utility patent application Ser. No. 13/964,094, entitled "System and Method for 3D Imaging using Structured Light Illumination," filed Aug. 11, 2013, pending, which claims priority pursuant to 35 U.S.C. §120, as a continuation application, to the following U.S. Utility Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes:

2. U.S. Utility patent application Ser. No. 13/751,985, entitled "System and Method for 3D Imaging using Structured Light Illumination," filed Jan. 28, 2013 and issued as U.S. Pat. No. 8,509,501 on Aug. 13, 2013, which claims priority pursuant to 35 U.S.C. §120, as a continuation application, to the following U.S. Utility Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility patent application for all purposes:

3. U.S. Utility patent application Ser. No. 13/527,704, entitled "System and Method for 3D Imaging using Structured Light Illumination," filed Jun. 20, 2012 and issued as U.S. Pat. No. 8,363,907 on Jan. 29, 2013, which claims priority pursuant to 35 U.S.C. §120, as a divisional application, to the following U.S. Utility Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes:

4. U.S. Utility patent application Ser. No. 11/586,473, entitled "System and Method for 3D Imaging using Structured Light Illumination," filed Oct. 25, 2006, now U.S. Pat. No. 8,224,064 issued on Jul. 17, 2012, which claims priority pursuant to 35 U.S.C. §119(e) to the following U.S. Provisional Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes:

a. U.S. Provisional Patent Application Ser. No. 60/730,185, filed Oct. 25, 2005.

U.S. Utility patent application Ser. No. 11/586,473 also claims priority pursuant to 35 U.S.C. §120, as a continuation-in-part (CIP), to the following U.S. Utility Patent Application which is hereby incorporated herein by reference in its entirety and made part of the present U.S. Utility Patent Application for all purposes:

1. U.S. Utility patent application Ser. No. 10/444,033, entitled "System and Technique for Retrieving Depth Information about a Surface by Projecting a Composite Image of Modulated Light Patterns," filed May 21, 2003, now U.S. Pat. No. 7,440,590 issued on Oct. 21, 2008.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

The U.S. Government has a paid up license in this invention and the right in limited circumstances to require the patent owner to license others on reasonable terms as provided for by the terms of Contract No. 2004IJ-CX-K055

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awarded by the National Institute of Justice, through subcontract with Eastern Kentucky University Contract: 06-202.

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

This invention relates to biometrics, and in particular to three dimensional (3D) imaging using structured light illumination for biometrics.

2. Description of Related Art

Biometrics is the science of measuring and analyzing biological data. In law enforcement and security fields, biometrics is used to measure and analyze human features, such as fingerprints, facial patterns, hand measurements, retinas, etc. Well known biometric measurements are fingerprints and palm prints. Fingerprints and palm prints are now and, for the foreseeable future the most relied upon biometric measurements for verifying a person's identity and also for linking persons to a criminal history and background checks. Criminal justice agencies rely on fingerprints and palm prints for positive identification to latent prints collected as evidence at crime scenes and in processing persons through the criminal justice system.

The National Institute of Science and Technology (NIST) and the American National Standards Institute (ANSI) supports the ANSI/NIST-ITL 1-2000 Data Format for the Interchange of Fingerprint, Facial, & Scar Mark & Tattoo (SMT) Information. This standard defines the content, format, and units of measurement for the exchange of fingerprint, palm print, facial/mug shot, and scar, mark, & tattoo (SMT) image information that may be used in the identification process of a subject. The information consists of a variety of mandatory and optional items, including scanning parameters, related descriptive and record data, digitized fingerprint information, and compressed or uncompressed images. This information is intended for interchange among criminal justice administrations or organizations that rely on automated fingerprint and palm print identification systems or use facial/mug shot or SMT data for identification purposes. Other organizations have different standards as well for the content, format or units of measurement for biometric information.

The traditional method of finger print acquisition to meet such standards is to roll an inked finger onto a paper sheet. This method of rolling an inked finger onto a paper sheet converts the inked 3D finger print into a two dimensional (2D) image on the paper sheet. The 2D image of the inked 3D finger print is then converted into an electronic version, such as by scanning. The electronic fingerprint and palm-print images meeting specified standards allow for the rapid search of matching print images in extremely large databases of existing fingerprint and palm-print based records. For example, the FBI maintains an Interstate Identification Index System for fingerprints and palm prints.

Though the need for accurate and fast biometric identification is increasing, the above described known process of rolling an inked fingerprint has many limitations. The rolled ink print technique is slow and cumbersome and often produces finger prints and palm prints of poor quality. It requires a trained technician to grasp and manipulate a person's finger or hand, and even then it may take multiple attempts to successfully capture a print that meets industry standards. The rolled finger prints and palm prints can only be captured one at a time thus creating a very slow image capture process that may take 5 to 10 minutes or more. Small amounts of contamination or excessively dry or moist skin can hamper or even preclude the capture of an acceptable image. Finger prints and palm prints of some persons with fine or worn friction ridges